

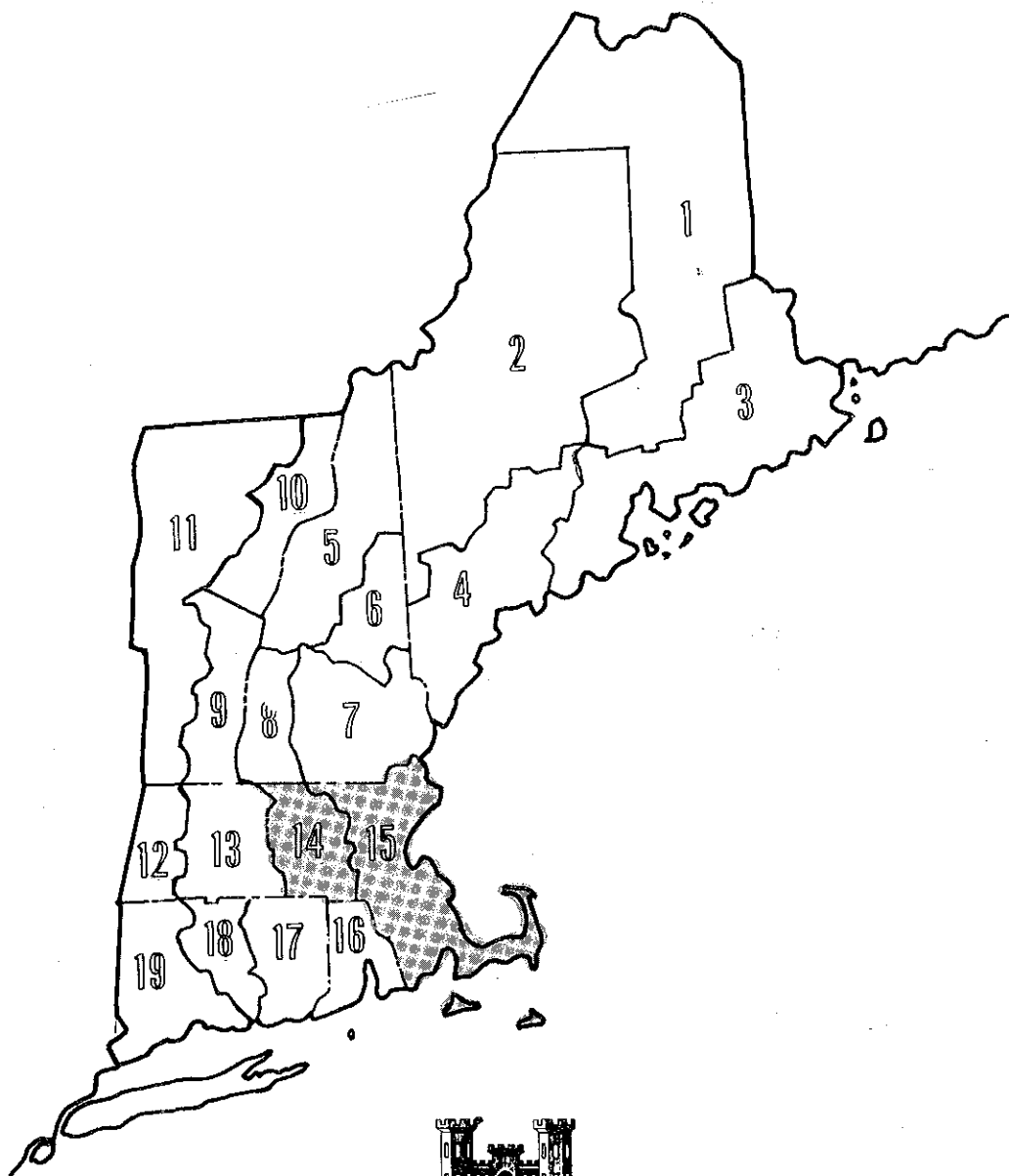
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NORTHEASTERN UNITED STATES WATER SUPPLY STUDY

WORCESTER-BOSTON

OBE SUB-REGION 14&15

INTERIM MEMORANDUM NO.7



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

SEPTEMBER 1968

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(OBE Sub-Regions 14 and 15)

NEW ENGLAND DIVISION
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ABSTRACT

The Worcester-Boston Sub-Regions are investigated to determine future potential water supply requirements. Five areas with present and future water supply problems are investigated. The capability of these systems to meet these needs are discussed. Recommendations for funds are requested under "NEWS" legislation (PL 89-298) to carry out further study of the sub-regions.

Worcester-Boston Sub-Regions
OBE Sub-Regions 14 and 15
Interim Memo No. 7

1. Purpose of Report

This Interim Memo, submitted in accordance with scope of work detailed in Memorandum dated 21 November 1967, is part of this Division's participation in the Northeast Water Supply Study for the New England area.

2. Scope of Studies

This memo reviews water supply requirements of those municipalities within sub-regions 14 and 15 which do not fall within the present legislative boundaries of the Boston Metropolitan Water District. Although findings presented are of a preliminary nature they do highlight certain areas which may find it advantageous to connect to the MDC system. The potential effect of these municipalities connecting to the MDC system is discussed. Possible additional sources, conveyances and routing required to enable the MDC system to meet such an added demand are explored and outlined. A listing of counties in the sub-regions together with 1960 populations and a location plan is shown on Plate No. 1.

3. Prior Interim Memos

Interim Memo No. 7 is the third report, of reconnaissance scope, which studies the Worcester-Boston sub-regions as shown on Plate No. 1. Interim Memo No. 5 covered the existing Metropolitan District Commission system, its projected water requirements and its capability to meet these future demands. Interim Memo No. 6 reported the future requirements of those municipalities which have statutory right to connect to the MDC under existing legislation but which have not as yet exercised this option. It is intended that the three memoranda Nos. 5, 6 and 7 be viewed as an outline of the sub-regions total water supply requirements.

4. Expected Water Deficit Areas

a. General. The population projections and future water requirements presented in this report are of a preliminary nature and do not include any possible shift of heavy water using industry from outside the sub-regions to the systems studied. The projections and future water demands are, however, of sufficient accuracy to provide a reasonable assessment of available resources compared to future requirements, and afford an indication of potential deficit areas.

Areas within the sub-regions, as shown on Plate No. 2 which now have or may face water supply problems in the future are as follows: (1)

1. City of Fitchburg (2)
2. City of Worcester (2)
3. Ipswich River Watershed District
4. Municipalities within Upper Charles River Basin
5. Central Plymouth County Water District

b. City of Fitchburg. The City of Fitchburg, with a reported 1965 population of 43,087, is located in North-Central Massachusetts. The city registered an average annual water supply consumption in 1966 of about 9.5 mgd. (3) In 1962 it was 10.3. The city's water system is characterized by particularly heavy industrial water use (more than 60%) a fact which is readily apparent from a study of the municipalities' growth over the last five decades. The population in 1920 was 41,029 and the growth pattern to date has been almost static while water consumption has experienced an increase of 5.1 mgd, rising from 4.4 mgd in 1920 to 9.5 mgd in 1966.

The heavy industrial consumption in the city makes normal per-capita projections for future water requirements an inadequate procedure, therefore, consumption projections for the city were based on recent trends.

The city's present average annual demand of 9.5 mgd is equal to the existing system's safe yield. Plans currently under consideration would, upon construction, add some 3.9 mgd to available yield. This addition, however, would only meet the city's need through about 1975. Beyond 1975 additional sources would be needed to meet the system's requirements.

(1) This list does not include the New Bedford-Fall River area which was reported in Memo No. 1.

(2) Although only the cities needs were considered in this report, a more detailed study would include the needs of the surrounding communities in development of a water resource plan.

(3) In 1962 the water consumption was 10.3 mgd, exceeding the safe yield of the system. Since 1964 to the present the municipality has had either voluntary conservation or mandatory restrictions on water use.

There are at least two alternatives for the Fitchburg water supply system to meet its future needs, that is, beyond 1975. One alternative plan might be for the city to participate in water supply purposes in an authorized multi-purpose Corps of Engineers plan in the North Nashua River Basin. (1) Another alternative plan would be connection of the city's system to the MDC. (2) The latter would shift the development burden to the MDC, as would connection by other systems.

c. City of Worcester. The City of Worcester is the largest city in Central Massachusetts. The 1965 population was reported to be 186,000 and projections estimate the city to have an ultimate population of some 206,000 by the year 2020.

The City's average annual consumption was 24.8 mgd in 1965 and this figure is projected to be 30 mgd by 1980, 36 mgd by 2000 and some 40 mgd by the year 2020. The present safe yield of the existing system is estimated to be 24.8 mgd. Development of other economically potential sources may add some 3.2 (3) mgd more, but assuming that these additional sources are developed the safe yield of the system would be exceeded about 1975. Development of other sources to meet the future water requirements appear to be economically scarce. "An alternative" solution for the city might be connection to the MDC.

d. Ipswich River Watershed District. The Ipswich River Watershed District is comprised of some 23 cities and towns in or adjacent to the actual watershed of the river. Population (4) of those municipalities of the district which use or will use this resource was about 360,000 in 1965. It is estimated to be about 430,000 in 1980, 500,000 by 2000 and 550,000 by the year 2020.

(1) Water Resources Development Plan, North Nashua River Basin, Merrimack River, Massachusetts, New England Division, 25 January 1965.

(2) A neighboring city, Leominster, recently completed a connection to the MDC, but these facilities were sized only for Leominster's future needs, and do not include provisions to include Fitchburg.

(3) Does not include further well development at Lake Quinsigamond because of possible legal constraints.

(4) Based on a report to the Massachusetts House of Representatives, House Doc. #4100 of the year 1965 -- These figures reflect those 18 municipalities who are present or potential users of water from the Ipswich River Basin.

Consumption (1) of the district was about 43 mgd in 1963 and is projected to increase to 63 mgd by 1980, 85 mgd in 2000 and about 106 mgd by the year 2020. The water resources of the Ipswich River Basin will probably be unable to meet the water demand beyond about 1990. In order to meet its future water requirements water will have to be imported into the basin.

Two sources of surface water appear to be favorably situated for importation into the basin. These are the Concord (a tributary of the Merrimac River) and the Merrimac Rivers. Both of these sources would probably require complete treatment and both have a portion of their flow presently used for water supply purposes by municipalities outside the district. Extension of the MDC system into the basin could be considered as an attractive third alternative.

All three alternatives must be evaluated as to their respective merits before a plan of development could be formulated.

e. Upper Charles River Basin. There are 11 municipalities within the upper Charles River Basin which are ineligible under present legislation to join the Metropolitan Water District.

These municipalities had a reported 1965 population of 83,913 and projections indicate populations of 135,000 by 1980, 245,000 by 2000 and 355,000 by the year 2020. The advent of a new outer circumferential highway Rte. 495 to the west of already famous Rte. 128 ("Electronic Row") makes this area of Massachusetts extremely attractive for added growth.

Consumption projections indicate water requirements will rise from an estimated 6 mgd in 1965 to 12 mgd in 1980, about 29 mgd in 2000 and 51 mgd by the year 2020.

Preliminary estimates indicate that portions of this basin will probably have to import water to meet future needs. The proximity of the Sudbury River Reservoir system portion of the Metropolitan District Commission appears to suggest use of this system to meet future needs. Another but more remote possibility to meet this requirement includes extension of the Providence, Rhode Island, water system to this area.

(1) op. cit. House Doc. #4100, 1965

f. Central Plymouth County Water District. The Central Plymouth County Water District is composed of some 8 communities of which the City of Brockton is the urban core. The district had a 1965 population of 122,406 and is expected to reach 174,000 by 1980, 245,000 by 2000 and about 300,000 by the year 2020. The districts water supply requirements are projected to increase from its 1965 level of 9 mgd to 16 by 1980, 25 by 2000 and 34 mgd by the year 2020.

The city of Brockton water system services the city itself and the towns of Hanson and Whitman. These three municipalities in 1965 alone accounted for 85% of the water requirements of the district. Although it is recognized that the surrounding communities will grow faster than the core area; projections indicate that by 1990 Brockton, Hanson and Whitman will still utilize about 75% of the district's water supply. Since the Brockton system is the major supplier in the district, it is upon this system that this study has focused its attention.

The Brockton system at present has a safe yield estimated to be about 11.9 mgd. Consumption projections indicate that an additional source will be required before 1980. A tentative plan to divert water from the Jones River would, depending on the intake location, add some 6.6 mgd to 7.8 mgd to the system yield. This addition would allow the Brockton system to meet its water requirements to about 1990 or in conjunction with the other municipalities of the district would service the entire district to about the mid 1980's.

Water requirements of the district beyond 1990 may be met by other sources nearby the district, notably diversion from the North River. Development of this resource for the district's use however, will depend on the adjacent non-district municipalities growth and accompanying water needs.

5. Discussion and Summary

A number of areas within the Worcester-Boston sub-regions will likely face difficulties in meeting their future water supply demands. In this memo the five largest areas have been studied and reported upon, but other areas also exist.

The importance of these areas to the sub-regions future water supply planning can be readily evaluated by referral to the following tables.

TABLE 1

POPULATION PROJECTIONS

	<u>1965</u>	<u>1980</u>	<u>2000</u>	<u>2020</u>
Fitchburg	43,087	43,500	44,000	44,500
Worcester	186,000	190,000	201,000	206,000
Ipswich R. Water (1)				
District	339,998	429,800	502,400	545,900
Upper Charles River				
Basin (2) (3)	83,913	135,000	243,000	354,000
Central Plymouth County				
Water District	<u>122,406</u>	<u>174,000</u>	<u>245,000</u>	<u>300,000</u>
	794,404	972,300	1,235,400	1,450,400

TABLE 2

CONSUMPTION PROJECTIONS

Fitchburg	8.4	16	20	25
Worcester (4)	24.8	30	36	40
Ipswich R. Water				
District (5)	43.2 (1)	63	85	106
Upper Charles River				
Basin	6	12	29	51
Central Plymouth County				
Water District	<u>9 (6)</u>	<u>16</u>	<u>25</u>	<u>34</u>
	91.4	137	195	256

(1) op. cit. House Doc. #4100, 1965

(2) Based on Metropolitan Area Planning Council Projections

(3) Projections are for those municipalities not within present MDC legislative boundaries.

(4) Based on a report by Coffin & Richardson, Engineers

(5) 1963 Consumption

(6) Estimated

It appears that 3 of these areas, namely, Fitchburg, Worcester and portions of the Upper Charles River Basin may find that connection to the MDC system could be the most economical solution to their water supply problems. However, the MDC probably would be reluctant ((1) about extension of its service to these areas unless a new major source (in addition to the Northfield Mountain Project and the Tully Project) is added to the system.

As described in Memo No. 6 in Paragraph 7, "Possible Sources of Water for Future Development", there appear to be at least 3 sources which could be added to the MDC system. Two of these sources, the Deerfield and Tully Rivers, are tributary to the Connecticut River and the third source is the Merrimac River. Development of these resources with accompanying conveyances and treatment facilities could possibly enable the MDC system to allow these "have not" areas to meet their water needs.

The other potential water deficit areas, the Ipswich River Water District and the Central Plymouth County Water District appear to have economically developable resources available in proximity to their districts. The potential yield of these sources is somewhat "clouded" however by the as yet unknown demands of municipalities outside of the districts but also close to the resource. It may well be that these local resources will be, unable to meet the total demand placed upon them. Should this happen, the districts may then look to the MDC for a solution to their water problems.

A study of this scope cannot determine with accuracy which of the areas discussed will seek admittance to the MDC system, but as the more economically attractive resources are developed pressure for admittance to the MDC system from these areas can be expected. Development of plans to meet these potential demands as well as the future requirements of the present system and those legislatively eligible municipalities must proceed if sub-regions 14 and 15 are to be insured future adequate water supplies.

6. Findings

The nature of this study precluded the formation of definite engineering conclusions and recommendations. The report does, however, point to those areas which could expect difficulties in meeting future water supply requirements. Broad courses of action to meet these future water deficits are discussed but further study is required to assure the optimum use of available resources. Further study ((2) would include, but not be limited to the following items:

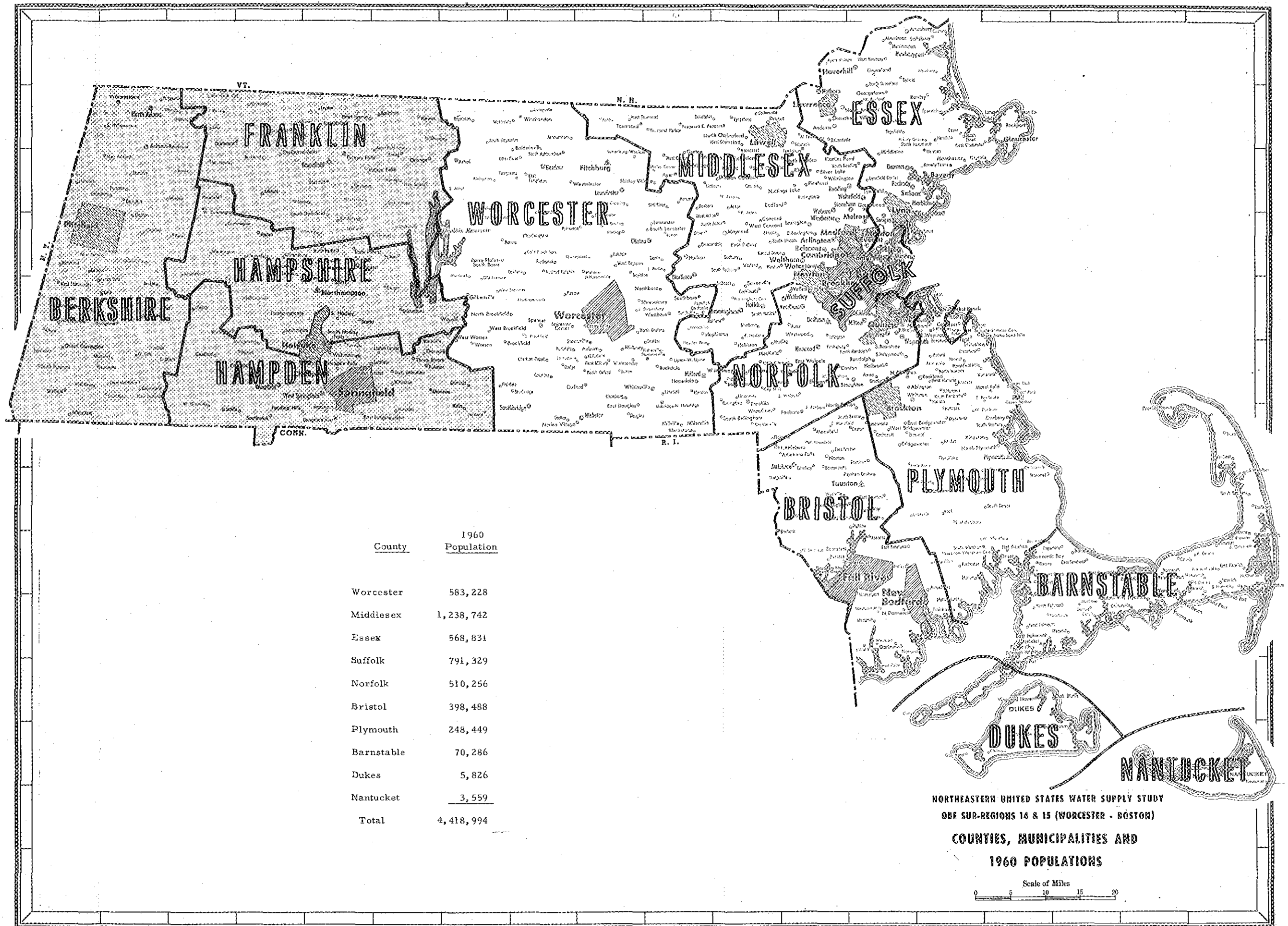
1. Hydrology
 2. Water Supply Requirements
 3. Identification of Urgent Water Supply Areas
 4. Development Potential of Local Resources
- (1) Aside from legislative restraints
- (2) Develop physical sizing, costs, etc. and alternatives such that decisions can be made on features which are deserving of further detailed engineering of survey scope coverage.

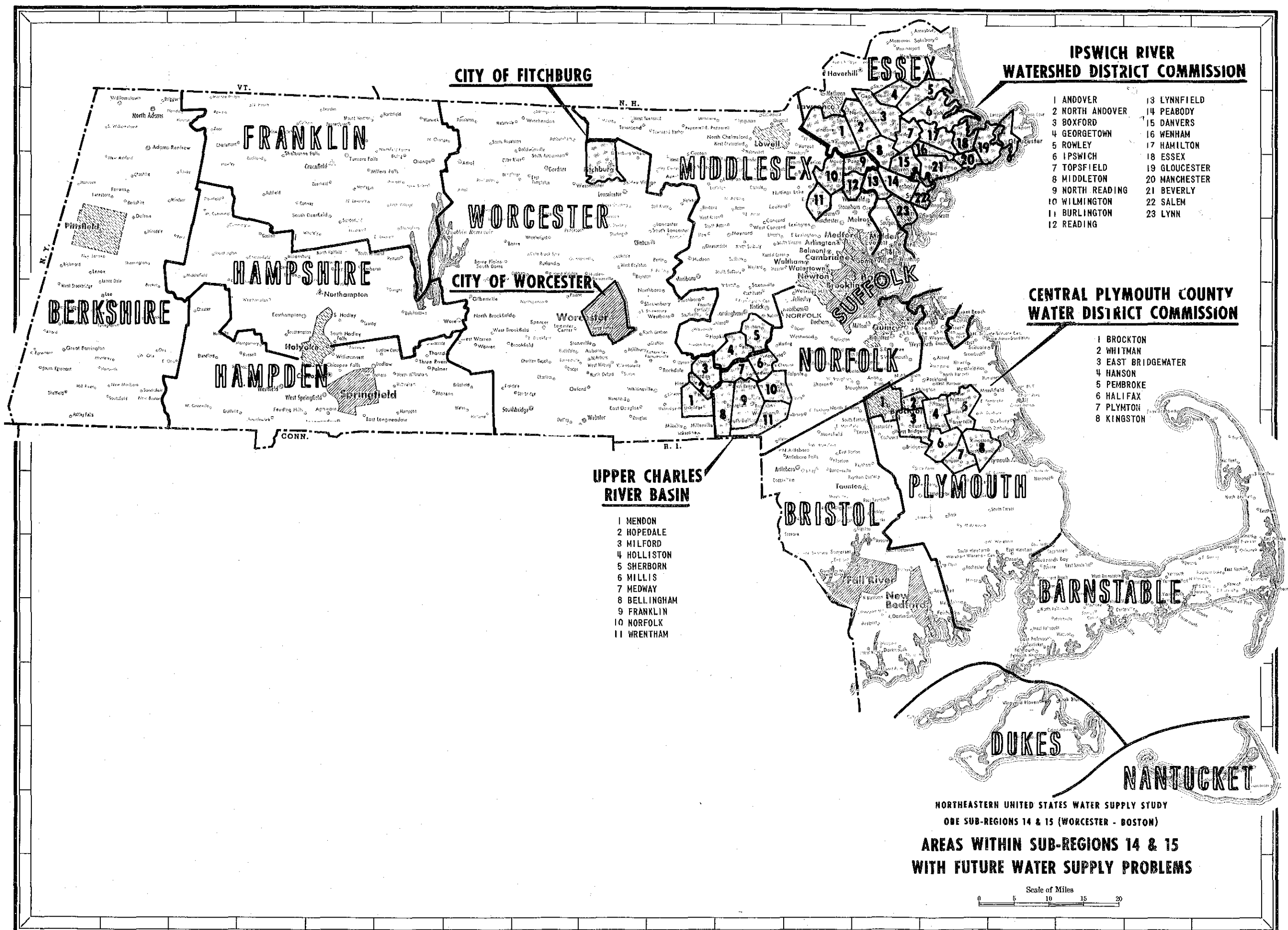
5. Required Development of Resources Outside of the Sub-Regions
6. Plan of Development Necessary to Meet Future Needs
 - a. Investigation of Reservoir Sites
 - b. Sizing and Routing of Conveyance Facilities
 - c. Sizing and Location of Treatment Facilities
7. Effect of Plan on Other Related Water Uses
 - a. Recreation
 - b. Pollution Abatement
 - c. Power
 - d. Flood Control
 - e. Navigation
8. Ecological and Environmental Considerations
9. Cost Studies
10. Recommendations and Findings
11. Implementation of System Development

7. Recommendations

In order to insure an adequate and dependable water supply for the sub-regions the following course of action is recommended:

1. Feasibility study of the Worcester-Boston Sub-Regions to determine in detail future populations and their water supply requirements. This study would investigate new sources to meet future demands, formulate plans, alternatives and recommend a plan of resource development for future water supply requirements of the sub-regions. Costs for a feasibility study of this scope are estimated to be \$300,000.
2. Survey report for modification of the Tully Dam (Millers River) and conveyance facilities to provide an additional water supply source for the MDC. The estimated cost of this work is \$120,000. (Dependent on results of Recommendation 1)





**IPSWICH RIVER
WATERSHED DISTRICT COMMISSION**

- | | |
|-----------------|---------------|
| 1 ANDOVER | 13 LYNNFIELD |
| 2 NORTH ANDOVER | 14 PEABODY |
| 3 BOXFORD | 15 DANVERS |
| 4 GEORGETOWN | 16 WENHAM |
| 5 ROWLEY | 17 HAMILTON |
| 6 IPSWICH | 18 ESSEX |
| 7 TOPSFIELD | 19 GLOUCESTER |
| 8 MIDDLETON | 20 MANCHESTER |
| 9 NORTH READING | 21 BEVERLY |
| 10 WILMINGTON | 22 SALEM |
| 11 BURLINGTON | 23 LYNN |
| 12 READING | |

**CENTRAL PLYMOUTH COUNTY
WATER DISTRICT COMMISSION**

- | |
|--------------------|
| 1 BROCKTON |
| 2 WHITMAN |
| 3 EAST BRIDGEWATER |
| 4 HANSON |
| 5 PEMBROKE |
| 6 HALIFAX |
| 7 PLYMOUTH |
| 8 KINGSTON |

**UPPER CHARLES
RIVER BASIN**

- | |
|--------------|
| 1 MENDON |
| 2 HOPEDALE |
| 3 MILFORD |
| 4 HOLLISTON |
| 5 SHERBORN |
| 6 MILLIS |
| 7 MEDWAY |
| 8 BELLINGHAM |
| 9 FRANKLIN |
| 10 NORFOLK |
| 11 WRENTHAM |

NORTHEASTERN UNITED STATES WATER SUPPLY STUDY
ONE SUB-REGIONS 14 & 15 (WORCESTER - BOSTON)
**AREAS WITHIN SUB-REGIONS 14 & 15
WITH FUTURE WATER SUPPLY PROBLEMS**

